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PROBATIONARY ESSAY

ON

FRACTURE OF THE CRANIUM,

SUBMITTED,

BY AUTHORITY OF THE PRESIDENT AND HIS COUNCIL,

TO THE EXAMINATION OF THE

Royal College of Surgeons of Edinburgh,

WHEN CANDIDATE FOR ADMISSION INTO THEIR BODY, IN
CONFORMITY TO THEIR REGULATIONS RESPECTING THE
ADMISSION OF ORDINARY FELLOWS.

BY

ALEXANDER BRYCE, M. D.

Condo et compono quæ mox depromere possim. — HORAT.

OCTOBER 1826.

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TO
ADAM HUNTER, Esq. M. D.

FELLOW OF THE ROYAL COLLEGE OF SURGEONS, EDINBURGH,

AND
ONE OF THE SURGEONS OF THE ROYAL INFIRMARY,

THIS ESSAY

IS HUMBLY DEDICATED,

AS A SMALL MARK OF RESPECT,

BY

HIS MUCH OBLIGED AND SINCERE FRIEND

THE AUTHOR.



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PROBATIONARY ESSAY

ON

FRACTURE OF THE CRANIUM.

FRACKTURE of the cranium is generally the consequence of a considerable degree of violence inflicted on the head, either from blows or falls on that part, and therefore becomes of itself a symptom of much importance, as indicating, that, from the force requisite to produce fracture of the bone, other and more serious effects may ensue.

The bones most liable to be fractured from their exposed situation, are the frontal, the two parietal, and the vertical part of the occipital bone ; but fracture is by no means confined to these : it may occur in any of the bones of the cranium, and the degree of injury they may sustain is very various. If the breach of continuity in the bone be

very small, it is termed a *fissure*; if more open, a *fracture*. If, along with fracture, a part of the bone is forced inwards upon the brain, it is called a *depressed fracture*. It sometimes happens also, that, in consequence of external injury, the skull may be fractured, but not at the place where the blow was inflicted; for example, a blow on the top of the head may produce a fracture at the base of the skull: this is termed a *counter fracture*, and cannot of course be attended with depression of the bone. Another variety is occasionally to be met with, in fractures of the different tables of the skull: sometimes the outer table alone suffers, and at others the inner table is fractured, while the outer remains entire; but most commonly they are more or less equally affected.

A simple breach of continuity in any of the bones of the skull, unattended by any of the more alarming symptoms of depression, extravasation, or concussion, is of comparatively little importance; for fractures of the cranium will, *cæteris paribus*, heal as readily as fracture in any other bone of the body; but the surgeon must always bear in mind, that, from the delicacy and importance of the contents of the skull, a blow sufficient to cause

a fracture of the bone will generally be attended by more or less disturbance of the functions of the brain ; and it is from the latter that those bad effects are to be apprehended which constitute fracture of the skull one of the most interesting cases of surgery.

If an injury of the head has been received, of such a nature as to cause a suspicion of fracture of the cranium, it becomes the duty of the surgeon to mark particularly those symptoms that may present themselves, indicative of derangement of the contents of the cranium, there being no peculiar marks diagnostic of a simple breach of the bone. If the supposed fracture be the only immediate effect of the injury, it will be sufficient to deplete the patient by bloodletting, purging and other antiphlogistic remedies, in order to guard against inflammation of the dura mater, and those dangerous consequences which are at all times liable to follow. Mr POTT recommends the operation of trephining to be performed in cases of simple undepressed fracture, “as,” to use his own words, “a prevention of such mischief as experience has shewn may most probably be expected from such kind of violence offered to the dura mater;” * but

* POTT's Works, vol. i. p. 104.

the dangerous consequences that may arise from the operation itself, combined with the well established fact of the frequent occurrence of cases which have been completely cured by depletion alone, sometimes even by the mere efforts of nature, have tended greatly to the disuse of this practice; so much so indeed, that at present no surgeon would consider himself authorised even to make an incision for the purpose of ascertaining the presence of the fracture, far less proceed to the application of the trephine. If, on the other hand, the patient, immediately on the receipt of the injury, has fallen into a state of stupor, from which he either cannot be roused, or that with much difficulty, and into which he again immediately relapses; if the face be pale, the extremities cold, the pulse oppressed, the breathing tranquil and without stertor, we may infer that he is labouring under the effects of concussion, and treat him accordingly. But if the state of stupor be accompanied by flushed countenance, slow pulse, vomiting, dilated pupils, and stertorous breathing, which are the general symptoms of compressed brain,—and more particularly if blood be effused from the nose or ears, a circumstance generally denoting fracture of the base

of the skull,—then, provided there be no depression of the bone, we may have reason to dread, that, along with the fracture, an extravasation of blood has taken place within the cranium.

Cases may, and very often do occur, in which the surgeon is much at a loss to distinguish whether the symptoms accompanying the fracture arise from compression, or from concussion, or from both. In a case of such a nature, I conceive the best practice to be, to wait for some time before proceeding to any active treatment; for, if the symptoms arise merely from concussion, they will cease when the reaction of the system commences, and an operation would only add to the danger of the patient; if the symptoms depend upon compression alone, a little time will give us a clearer idea of the nature of the case; and if concussion and compression coexist, the symptoms of the former will gradually depart, while those of the latter will become more apparent.

Although the diagnosis between compression and concussion is, in some favourable instances, very distinct, still, from the frequent complication of the two, from the inability of the patient to give an account of his situation, and from many

other circumstances, the surgeon is often placed in a very perplexing situation. Sir ASTLEY COOPER, in his *Surgical Lectures*, states, that what he has observed as the best marked symptoms of concussion are, a violent beating of the carotid arteries, an apparent tranquil sleep, an instantaneous relapse into that state after having been roused, a remarkable excitement of the pulse upon using exertion, and the insensibility having immediately followed the injury.

Such I conceive to be the various symptoms liable to attend *simple undepressed fracture* of the cranium, and which make their appearance either along with, or soon after, the receipt of the injury; but even should there be no material appearance of mischief at that time, the patient is not, by any means, to be considered exempt from danger; for it often happens that, at a period from the accident, sooner or later according to circumstances, he begins to complain of acute pain in his head, with sickness, languor, and feverishness; his pulse rises, and becomes hard, with increase of pain, and occasional rigors. Unless these symptoms subside, delirium, vomiting, dilated pupils, stertor and coma supervene, all of which arise from

inflammation attacking the neighbouring parts, and terminating in suppuration of the dura mater. At the commencement of these bad symptoms, free detraction of blood, both local and general, saline purgatives, nauseating doses of the tartrate of antimony, cold applications to the head, and the other means of depletion, are unquestionably the remedies best calculated to arrest their progress; but if, notwithstanding their employment, the symptoms of compression have come on, an operation must be resorted to,—the only chance of saving the patient's life being to give exit to the matter which has formed beneath the bone, by the immediate use of the trephine. If the injury of the head in such a case has been unattended by a wound of the integuments, the inflammation of the dura mater, and the formation of matter between it and the bone, will be indicated by the “puffy circumscribed tumour,” described by Mr POTT, beneath which the pericranium will be found separated from the bone.

Compound fracture of the cranium differs from that of which I have been treating, merely in being complicated with a wound of the integuments. In this case, we ought to endeavour, by healing

the wound as quickly as possible, to transform the injury into a simple fracture ; and the different symptoms which may occur, are to be treated as I have already mentioned under that head. If inflammation of the dura mater, and consequent suppuration, should supervene, the general symptoms mentioned above will likewise follow : besides which, the wound, although it may previously have been healing kindly, will, after a few days, put on a very different appearance ; the edges will lose their florid healthy colour, and become pale, flabby, and everted ; instead of good pus, a thin ichor will be discharged, and the pericranium will separate from the subjacent bone, thereby indicating a corresponding separation of the dura mater by the formation of matter, and requiring as the only remedy perforation of the bone.

When fracture of the cranium is complicated with extravasation of blood, the symptoms of compressed brain generally come on by degrees, in proportion to the extent of the effusion : these symptoms are, loss of voluntary motion and sensation, vomiting, dilated pupils, slow pulse, stertorous breathing, and relaxation of the sphincters ;

also very frequently paralysis of the side opposite to that on which the effusion has taken place.

As the places where extravasation of blood within the cranium may occur are so various, and as we are in possession of no marks which infallibly point out its situation, we ought, in such cases, to endeavour, by copious depletion, by blisters and purging, to promote its absorption. Were we even assured that the blood lay between the cranium and dura mater, it would become an important question where to apply the trephine; for the blood is often effused at a distance from the seat of injury. If, however, the fracture lay over the course of the middle meningeal artery, the blood would, in all probability, be effused from that vessel; and, accordingly, the trephine might be applied there with a greater chance of success.

It is worthy of remark, that, in some cases, a very small extravasation of blood gives rise to symptoms of compression; and that in others, although the extravasation be very extensive, yet none of these symptoms appear. A case illustrative of this came under my immediate observation, while filling the office of Dresser in the

Royal Infirmary, which, as it made a deep impression upon me at the time, I shall take the liberty here shortly to detail:—The patient fell from a height, and received a compound fracture of the left side of the frontal bone, near the coronal suture, but without depression, and unattended by any bad symptoms; he was, of course, bled, and kept on the antiphlogistic regimen, under which treatment he remained quite free from complaint for about ten days: After that, however, symptoms of inflammation and suppuration of the dura mater came on. The operation of trephining was performed, but with little success, and he died in a few days. On examination, a quantity of pus was found beneath the dura mater, and diffused over the left hemisphere; but the remarkable circumstance was, that there also appeared a coagulum of blood about the size of a hen's egg, lying upon the fore part of the anterior lobe of the left hemisphere, stretching upwards from the eyebrow between the dura mater and the bone, but at the distance of at least an inch and a-half from the nearest point of the fracture. This coagulum must have been effused at the time of the receipt of the injury; and yet there

were for so long a period no symptoms denoting extravasation, while sufficient cause for death existed in the subsequent suppuration of the dura mater. I observe, that Mr ALLAN has, in his System of Surgery, taken notice of this case, as illustrating how very imperfectly we are enabled, when the skull is fractured, to judge from existing symptoms of the extent of the injury.

I come now to notice *fracture, with depression of the bone.* This injury is much more dangerous than fracture without depression, not only from the effects of compression of the brain which generally follow depression of the bone, but also from the greater degree of violence that has been applied; whence other injuries, such as laceration of the brain, or its blood vessels, &c. may be complicated with it.

A simple depressed fracture may generally be discovered by manual examination. If the finger be passed over the seat of injury, a tumour will be felt on the part, which, over the depressed portion, will communicate a soft elastic sensation, when pressed upon. In this examination, we must be on our guard, however, not to be deceived by a tumour, which often follows a blow

on the head, and arises from an extravasation of blood below the tendon of the occipito-frontalis muscle. This tumour, when pressed upon, communicates to the fingers so very nearly the same kind of sensation as that arising from depressed fracture, that the faculty of properly distinguishing the one from the other must be acquired, in a great measure, from experience.

Simple depressed fracture, without symptoms of compression, does not require the use of the trephine; for, by the very act of dividing the integuments, the fracture is transformed from simple to compound, and the danger of subsequent inflammation then becomes much greater. An incision ought, therefore, never to be made on account of the depression, but only when the symptoms of compression demand it. Should there even be symptoms of compression, in a slight degree, it would be proper, before proceeding to the application of the trephine, to try well the effects of bleeding, purging, &c.; for many cases can be adduced in which these remedies have effected a cure, without the assistance of any other treatment. If the depressed fracture be complicated with a wound of the integuments even

without symptoms of compression, inflammation, according to Sir ASTLEY COOPER, is very apt to ensue, and therefore he advises that the trephine should, in such cases, always be applied, and that, as soon as possible, before the inflammation has come on; for, that then the patient has little chance of recovery, and will have still less, if the irritation of the operation be added to his other unfavourable symptoms. In opposition to this opinion of Sir A. COOPER, concerning the necessity of the operation in these cases, Mr ABERNETHY, in the second volume of his *Surgical Works*, has published the detail of several cases of compound depressed fracture, which were successfully treated by mere depletion. It becomes impossible, therefore, to lay down any rule for general observance in similar instances; and the surgeon must be very much guided as to his method of treatment by the nature and extent of the wound, the constitution of his patient, and other existing circumstances. If well marked symptoms of compressed brain take place upon receipt of the injury, and the bone be at the same time depressed, it will be necessary, as soon as possible, to apply the trephine, in order to elevate the bone, whe-

ther there be an external wound or not, and very frequently the relief is simultaneous with the operation ; of which I shall now proceed to offer some account.

The operation of trephining consists in removing a portion of bone from the cranium, and is generally performed to enable the surgeon to relieve symptoms of compression, arising either from depressed bone, extravasated blood, or suppuration of the dura mater. As this operation is of itself attended by very considerable danger, so it ought only to be had recourse to, when used as a *remedium ultimum* to save life ; and if that can be effected, as the patient will still be liable to the consequences of inflammation attacking the dura mater, these must be guarded against by the means so often already alluded to in the course of this essay.

Should it be necessary to apply the trephine in a case of undepressed fracture, it ought to be applied in the line of the fracture at its widest part. If a portion of bone be depressed, and at the same time firmly wedged, the pin of the trephine should rest on the sound bone, but the circle ought to include that part of the depressed portion where

it will be most readily set free; if the depressed bone, however, be not firmly fixed, the instrument should be applied entirely to the sound bone, but in such a manner, that the line of depression may form part of the circle. In some instances, the depressed portion of bone, from being loose or broken, can be raised by means of the levator; in which case, it ought always to be used in preference to the trephine.

There are several parts of the skull, over which, if we can possibly avoid it, we ought not to trephine: these parts are, over the sutures, over the longitudinal sinus, near the base of the skull, over the frontal sinuses, and over the anterior inferior angle of the parietal bone. When the trephine is applied over these parts, the operation becomes one of still greater delicacy, but the consequences are not so dangerous as to preclude the practice, provided sufficient care be taken, and the surgeon is aware of the inconveniences which are likely to ensue.

If the bone be laid bare, in consequence of a wound, we may proceed at once with the other steps of the operation; but if the integuments be

entire, a crucial incision, down to the bone, must first be made, and the flaps dissected back, but by no means removed, as that is quite unnecessary, and might be attended afterwards by serious consequences. The situation where the trephine is to be applied having been determined upon, the pericranium is there to be detached from the bone ; but this is a step little insisted on, as the pericranium can offer little resistance to the working of the instrument. The centre pin of the trephine is then to be inserted into the bone, and a few turns made, till a groove is formed, capable of containing the saw ; the pin is then to be withdrawn, and the working of the instrument to proceed cautiously and firmly, the surgeon taking care to make the pressure as equal as possible, in order that one part of the circle may not be cut through before the other : it is necessary to withdraw the instrument occasionally, in order to clear it from bone dust, and to ascertain by probing, to what depth it has gone. If too much reliance be placed upon the change of sound, and the bleeding when the instrument has arrived at the diploe, we may often be disappointed ; for in very

young, and in very old age, the skull is thin, and without diploe.

When the surgeon has reason to think that he has nearly cut through the bone, it will be better to withdraw the trephine altogether, lest the dura mater should be wounded, and finish the operation by detaching the portion of bone by means of the forceps ; if any spiculæ of bone remain on the inside of the aperture, they are to be removed by means of the lenticular. It often happens that one perforation is found inefficient : in such a case it has been recommended to repeat the operation once and again, until the opening be sufficiently large. I should imagine, however, that the saws invented by Mr HAY of Leeds, are better adapted than the trephine for enlarging an opening, for by them we can cut as much or as little as we please, and that, either in a straight or curved direction ; whereas by using the trephine we must always remove a circular piece of bone of a definite size. In some particular cases Mr HAY's saws seem calculated to supersede the use of the trephine altogether.

The operation being completed, we must proceed to the removal of the cause for which

it was undertaken ; if a portion of depressed bone caused compression, it must be raised by the levator ; if blood be effused, or matter found between the cranium and dura mater, it can be easily removed ; if, however, the effusion should happen to be situated under the dura mater, that membrane must be punctured ; although, by doing so, the result, for the following reasons, is much more precarious. In the first place, by wounding the dura mater, inflammation of that membrane, the consequences of which we have so much reason to dread, is more apt to ensue, and through the opening, a fungus of the brain is very likely to protrude. Also when fluid is effused in that situation, it is not confined, but widely diffused over the surface of the brain, and by its weight naturally gravitates to the base of the skull, so that very little may escape by the puncture, and the operation ultimately prove abortive.

When the object of the operation has been accomplished, the flaps of the wound are to be laid together over the hole, and covered by a slight compress of soft lint, secured by a proper bandage.

After the operation of trephining has been per-

formed, if no untoward circumstances arise, the wound granulates, and the aperture is filled up ; not, however, by ossific matter, but by a tendinous structure formed from the bone and dura mater. Such a favourable termination, however, does not always occur, for although the trephine may have given relief to one set of symptoms, yet the patient may be in very imminent danger, from the effects of that violent inflammation which arises from the injury and the operation conjointly.

Another source of danger also often springs up, which very frequently proves fatal, viz. Fungus of the Brain. This fungus grows up with astonishing rapidity, varying from the size of a pigeon's egg to that of a small orange, and arising from ulceration and suppuration of the brain, it protrudes through an opening in the dura mater; and if it should increase so as to fill up the aperture in the bone, it will, by confining the matter, induce all the symptoms of compression.

The method of treating this symptom is divided between pressure and excision ; some authors recommending the one, and some the other. If the fungus be small, and does not fill up the whole aperture in the bone, I should be inclined to adopt

the practice of Sir ASTLEY COOPER, and apply a compress of soft lint, steeped in lime water, and secured by adhesive plaster; the compress to be increased in thickness as the fungus diminishes in size, till at length it becomes covered by the cicatrization of the dura mater. Should the fungus, on the other hand, so protrude as to fill up the aperture and cause symptoms of compression, I would not hesitate to cut it off, as that practice is ascertained to be attended by no bad symptoms, and is sometimes followed by a permanent cure.

FINIS.